

Application No. 10/524,525
Amendment Dated 1/13/11
Reply to Office Action of 7/13/10

REMARKS

This Amendment is submitted in response to the Office Action mailed on July 13, 2010. Claims 24-45, 49 and 50 have been amended, claim 47 has been canceled without prejudice or disclaimer, and new claims 51-57 have been added. Claims 24-45 and 49-57 remain pending in the present application. In view of the foregoing amendments, as well as the following remarks, Applicant respectfully submits that this application is in complete condition for allowance and requests reconsideration of the application in this regard.

Applicant has also filed herewith a Request for Continued Examination so that Applicant's After Final Amendment will be entered and considered by Examiner.

On Page 3, paragraph 2, of the Office Action, the Examiner indicates that claim 50, previously identified as "Currently Amended" in Applicant's Supplemental Amendment mailed on May 4, 2010, is not properly identified since claim 50 in that prior communication does not show any changes by underlining.

However, as described in the Remarks section of the Supplemental Amendment, Applicant indicated that only the status identifier of claim 50 was amended to read "Currently Amended" in lieu of --Previously Presented-- as incorrectly indicated in the Amendment filed May 3, 2010. The amendments made to claim 50, showing the changes by underlining, were made in the Amendment filed May 3, 2010, with claim 50 being incorrectly identified as "Previously Presented" even though amendments were indeed made to that claim. The amendments made to claim 50 in the Amendment filed

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May 3, 2010 were incorporated into claim 50 as presented in the Supplemental Amendment filed May 4, 2010. Consequently, only the status identifier was corrected in the Supplemental Amendment filed May 4, 2010.

Claim 47 stands rejected under 35 U.S.C. §112, second paragraph, as allegedly being indefinite. However, since claim 47 has now been canceled, this rejection is now moot.

Claims 24-45 and 49-50 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Song et al., U.S. Patent No. 6,821,901 ("Song") in view of Ye et al., U.S. Patent No. 6,270,687 ("Ye et al.") and further in view of Yin et al., U.S. Patent No. 6,270,617 ("Yin et al."). Applicant respectfully traverses these rejections for the reasons set forth below and respectfully requests that the rejections be withdrawn.

By way of background, the Examiner will note that each of independent claims 24, 49 and 50 is directed to a method for dry-etching material from the surface of a silicon-containing substrate having an aluminum mask applied onto the substrate surface. As described in the Background section of the present application, one of the problems encountered when etching a substrate surface that is masked by an aluminum mask material is that during the etching process, the aluminum masking layer is etched with the etching of the substrate material. The etched aluminum masking layer tends to accumulate, *inter alia*, in the etching device which may ultimately result in the inductive coupling, and thus the etch rate, initially deteriorating and ultimately collapsing. See, Page 3, lines 1-14.

In accordance with one aspect of the present invention as recited in each of independent claims 24, 49 and 50, the problem of the aluminum mask material being etched and redeposited in the etching device is minimized by keeping the substrate at an adequate distance from the inductive coupling coil. To this end, as recited in each of independent claims 24, 49 and 50, the substrate surface is kept at a distance from the lower edge of the inductive coupling coil of at least two times the mean free path length of the plasma atoms, or at a distance of at least 8 cm from the lower edge of the inductive coupling coil.

In known dry etching processes, the etching parameters are strongly dependent on the involved materials. The involved materials are, on the one hand, the etch material and, on the other hand, the mask material. The parameters used in a dry etching process, and the technology involved in that process, are far from “one size fits all.”

As described above, each of independent claims 24, 49 and 50 relates to dry-etching a silicon-containing substrate under an aluminum mask. Silicon has a certain responsiveness to dry-etching parameters, and the aluminum mask is chosen in consideration of the silicon’s etching-responsiveness. Moreover, the mask material has a certain responsiveness to the dry-etching parameters as well. For example, aluminum has a certain re-deposition characteristic that is different from that of other materials.

In the context of the present invention, aluminum re-deposition is undesired because aluminum is conductive so that it compromises the inductive coupling during the etching process. Thus, while an aluminum mask is used in the dry etching process recited in each of independent claims 24, 49 and 50, the recited cavity depths and etch rates are achieved while the substrate surface is separated from the lower edge of the inductive coupling coil by the recited distances so that the adverse effects of aluminum re-deposition within the chamber are minimized.

In the rejections of independent claims 24, 49 and 50, the Examiner properly recognizes that while *Song et al.* may be directed to dry etching of a substrate having an aluminum mask material, *Song et al.* fails to fairly teach or suggest keeping the substrate surface at a distance from the lower edge of the inductive coupling coil of at least two times the mean free path length of the plasma atoms, or at least a distance of at least 8 cm from the lower edge of the inductive coupling coil as recited in these claims.

In an attempt to cure this deficiency in *Song et al.*, the Examiner refers to the etching processes disclosed in *Ye et al.* and *Yin et al.* However, Applicant respectfully submits that each of these secondary references actually teaches away from the claimed invention as recited in each of independent claims 24, 49 and 50. In particular, *Ye et al.* and *Yin et al.* are directed to etching processes wherein aluminum *is* the etched material rather than the masked material as claimed. See, *Ye et al.* at

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Col. 2, line 59 through Col. 3, line 9, Col. 3, lines 58-61 and Col. 4, lines 9-12 and *Yin et al.* at Col. 2, lines 54-60, Col. 3, lines 17-23, Col. 13, lines 3-6 and Col. 16, lines 5-8.

Contrary to the Examiner's assertion, Applicant respectfully submits that one of ordinary skill in the art would not be motivated to combine the teachings of *Ye et al.* and *Yin et al.* with the teaching of *Song et al.* since one of ordinary skill in the art would not be motivated to incorporate the parameters of the etching processes disclosed in *Ye et al.* and *Yin et al.*, which are designed for etching aluminum as the etch material, when aluminum is the mask material as taught by *Song et al.* Indeed, *Ye et al.* teaches that the re-deposition of aluminum within the etching chamber is harmless and has no significant effect on the plasma characteristics. See, Col. 2, lines 59-67.

This is in stark contrast to the objective of the claimed invention of separating the substrate surface from the lower edge of the inductive coupling coil since the re-deposition of aluminum within the etching chamber does indeed have an effect on the plasma characteristics over time and thus the desire to separate the substrate surface from the lower edge of the inductive coupling coil by the distances as claimed. Consequently, *Ye et al.* and *Yin et al.* strongly teach away from the present invention as claimed.

In view of the above, Applicant respectfully submits that the Examiner has failed to establish a *prima facie* case of obviousness since one of ordinary skill in the art would not be motivated to combine *Song et al.*, *Ye et al.* and *Yin et al.* as sought in

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the rejections of independent claims 24, 49 and 50, and the rejections of these claims should be withdrawn.

Moreover, as claims 25-45 and 51-57 depend from allowable independent claims 24, 49 and 50, and further as each of these claims recites a combination of steps not fairly taught or suggested by the prior art of record, Applicant submits that these claims are allowable as well.

CONCLUSION

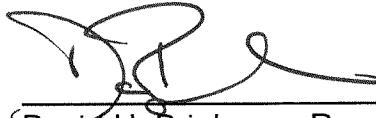
In view of the foregoing response including the amendments and remarks, this application is submitted to be in complete condition for allowance and early notice to this affect is earnestly solicited. If there is any issue that remains which may be resolved by telephone conference, Examiner is invited to contact the undersigned in order to resolve the same and expedite the allowance of this application.

Please see the electronic fee calculation sheet for the charge in the amount of \$260 for five extra claims as required by 37 C.F.R. §1.16(i), the charge in the amount of \$1,110 for the three months extension fee as required by 37 C.F.R. §1.17(a)(3) and the charge in the amount of \$810 for the Request for Continued Examination as required by 37 C.F.R. §1.17(e). If any other fees are necessary, the Commissioner is hereby authorized to charge any underpayment or fees associated with this communication or credit any overpayment to Deposit Account No. 23-3000.

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Respectfully submitted,

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